

CLAIMS

What is claimed is:

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1. A semiconductor device assembly, comprising:
a semiconductor die having an active surface having a plurality of bond pads thereon and
an opposing second surface;
at least one projection connected to at least one bond pad of said plurality of bond pads on
the active surface of said semiconductor die for connection to a substrate; and
a paddle of a lead frame of a plurality of lead frames having side rails connected to said
paddle, said second surface of said semiconductor die secured to said paddle.
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2. The semiconductor device assembly of claim 1, wherein said at least one
projection includes a plurality of projections comprising a ball grid array (BGA) of solder
balls.
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3. The semiconductor device assembly of claim 1, wherein said at least one
projection comprises at least one ball deposited by a wire bonding machine.
4. The semiconductor device assembly of claim 1, wherein said at least one
projection comprises at least one stud bump deposited by a wire bonding machine.
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5. The semiconductor device assembly of claim 1, further comprising:
an electrically non-conductive adhesive layer securing said second surface to said paddle.
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6. The semiconductor device assembly of claim 5, wherein said adhesive
layer comprises one of epoxy and polyimide.

5 sub B3 7. The semiconductor device assembly of claim 1, further comprising:
an electrically conductive adhesive layer securing said second surface of said
semiconductor die to said paddle.

8. The semiconductor device assembly of claim 7, wherein said electrically
conductive adhesive layer comprises a eutectic material.

9. The semiconductor device assembly of claim 7, wherein said electrically
conductive adhesive layer comprises a gold-silicon eutectic material.

10 10. The semiconductor device assembly of claim 7, wherein said electrically
conductive adhesive layer comprises a metal-filled polymer, said metal filling comprising
a heat conductive material.

15 11. The semiconductor device assembly of claim 7, wherein said electrically
conductive adhesive layer comprises conductive polyimide.

20 12. The semiconductor device assembly of claim 1, further comprising:
said substrate having circuit connections, said plurality of bond pads bonded to said
circuit connections.

25 13. The semiconductor device of claim 12, further comprising:
sealant packaging material enclosing a portion of said semiconductor die and covering a
portion of said substrate.

30 14. A semiconductor device assembly, comprising:
a semiconductor die having an active surface having at least one bond pad thereon and an
opposing second surface;

at least one projection secured to said at least one bond pad on said active surface of said semiconductor die for connection to a substrate; and
a metal paddle from a lead frame, said second surface of said semiconductor die attached to said paddle.

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15. The semiconductor device assembly of claim 14, wherein said at least one projection comprises a ball grid array (BGA) of solder balls.

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16. The semiconductor device assembly of claim 14, wherein said at least one projection comprises at least one ball deposited by a wire bonding machine.

17. The semiconductor device assembly of claim 14, wherein said at least one projection comprises at least one stud bump deposited by a wire bonding machine.

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18. The semiconductor device assembly of claim 14, further comprising:
an electrically non-conductive adhesive layer attaching said second surface to said paddle.

19. The semiconductor device assembly of claim 18, wherein said adhesive layer comprises one of epoxy and polyimide.

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20. The semiconductor device assembly of claim 14, further comprising:
an electrically conductive adhesive layer attaching said second surface to said paddle.

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21. The semiconductor device assembly of claim 20, wherein said electrically conductive adhesive layer comprises a eutectic material.

22. The semiconductor device of claim 20, wherein said electrically conductive adhesive layer comprises a gold-silicon eutectic material.

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23. The semiconductor device assembly of claim 21, wherein said electrically conductive adhesive layer comprises a metal-filled polymer, said metal filling comprising a heat conductor.

5 24. The semiconductor device assembly of claim 21, wherein said electrically conductive layer comprises conductive polyimide.

10 25. The semiconductor device assembly of claim 14, further comprising: a substrate having a plurality of circuit connections, said at least one bond pad connected to at least one circuit connection of said plurality of circuit connections.

26. The semiconductor device assembly of claim 25, further comprising: sealant packaging covering a portion of said semiconductor die and a portion of said substrate.

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15 27. A semiconductor device assembly, comprising:
a semiconductor die having an active surface having a plurality of bond pads thereon and an opposing second surface;
a plurality of projections connected to said plurality of bond pads for connection to a host circuit board, and
20 a metallic paddle secured to said second surface of said semiconductor die.

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25 28. The semiconductor device assembly of claim 27, wherein said plurality of projections comprises a ball grid array (BGA) of solder balls.

29. The semiconductor device assembly of claim 27, wherein said plurality of projections comprises balls deposited by a wire bonding machine.

30. The semiconductor device assembly of claim 27, wherein said plurality of projections comprises a plurality of stud bumps deposited by a wire bonding machine.

31. The semiconductor device assembly of claim 27, further comprising: an electrically non-conductive adhesive layer connecting said second surface to said paddle.

32. The semiconductor device assembly of claim 31, wherein said adhesive layer comprises one of epoxy and polyimide.

33. The semiconductor device assembly of claim 27, further comprising: an electrically conductive adhesive layer connecting said second surface to said paddle.

34. The semiconductor device assembly of claim 33, wherein said electrically conductive adhesive layer comprises a eutectic material.

35. The semiconductor device assembly of claim 33, wherein said electrically conductive adhesive layer comprises a gold-silicon eutectic material.

36. The semiconductor device assembly of claim 33, wherein said electrically conductive adhesive layer comprises a metal-filled polymer, said metal filling comprising a heat conductive material.

37. The semiconductor device assembly of claim 33, wherein said electrically conductive adhesive layer comprises conductive polyimide.

38. The semiconductor device of claim 27, further comprising: a substrate having a plurality of circuit connections, said plurality of bond pads connected to said plurality of circuit connections.

abc 39. The semiconductor device assembly of claim 38, further comprising:
sealant packaging covering a portion of said semiconductor die and a portion of said
substrate.

5 40. A paddle frame strip providing a plurality of heat sinks, each heat sink
connected to a surface of a semiconductor die, comprising:
an elongate metallic strip, comprising:
left and right rails;
a plurality of paddle frames positioned between said left and right rails;
10 wherein each of said plurality of paddle frames includes a plurality of cross members
joining said left and right rails, a generally centrally positioned paddle, and
support bars supportably joining said paddle to said cross members and to said
rails.

15 41. The paddle frame strip of claim 40, wherein said paddle frame strip is
leadless.

42. The paddle frame strip of claim 40, wherein said paddle frame strip
comprises at least one heat sink.

20 43. The paddle frame strip of claim 40, wherein said paddle has a suitable
thickness for a heat sink.

25 44. The paddle frame strip of claim 40, wherein said paddle frame strip is
formed of one of aluminum, silver, and alloys thereof.